filling the light propagating channel with a core material to form a core;

forming an upper cladding over the core.

2. The method of claim 1 further comprising planarizing the core material and the lower cladding prior to forming an upper cladding over the core.

3. The method of claim 2 wherein planarizing the core material and the lower cladding comprises etching or chemical mechanical polishing.

4. The method of claim 1 wherein the lower cladding is deposited on a substrate.

5. The method of claim 1 wherein the lower cladding comprises a material having a refractive index lower than the refractive index of the core material.

K1 cont

6. The method of claim 1 wherein the lower cladding is a substrate.

7. The method of claim 1 wherein forming the light propagating channel in the lower cladding comprises patterning and etching a light propagating channel in the lower cladding.

8. The method of claim 6 wherein forming the light propagating channel in the lower cladding comprises patterning and etching a light propagating channel in the substrate.

9. The method of claim 4 wherein the core material comprises PSG, GeO_2, SiON, Si_3N_4, and silicon.

10. The method of claim 9 wherein the lower cladding comprises a material selected from the group of USG and undoped silica.

11. The method of claim 10 wherein the upper cladding comprises BPSG.

12. The method of claim 9 wherein forming the upper cladding comprises depositing a film using chemical vapor deposition or physical vapor deposition techniques.

13. The method of claim 1 wherein forming an upper cladding comprises bonding a pre-formed upper cladding to the lower cladding and the core.

14. The method of claim 1 wherein the upper cladding is formed using a sol gel process.

15. The method of claim 13 wherein the upper cladding is bonded to the core using an adhesive.

A1, cont

16. The method of claim 15 wherein the adhesive comprises an epoxy.

17. The method of claim 15 wherein the adhesive has a refractive index the same as or similar to the upper cladding.

18. The method of claim 7 wherein the light propagating channel is formed in the lower cladding and at least a portion of the lower cladding is disposed below the light propagating channel.

19. The method of claim 7 wherein the light propagating channel is formed in the lower cladding and a substrate on which the lower cladding is deposited forms a lower surface of the core.

20. The method of claim 18 wherein the lower cladding disposed below the core is less than 5μm.

21. The method of claim 20 wherein the lower cladding disposed below the core is less than 3μm.

22. The method of claim 15 wherein the adhesive is selected to have a refractive index suitable to minimize loss or scattering of light conducted through the core.

23. The method of claim 18 wherein a portion of the lower cladding is disposed below the core to minimize the effects of birefringence.

24. The method of claim 6 wherein the substrate is selected to have suitable optical properties to act as a cladding and defines at least a portion of the core.

25. The method of claim 24 wherein the upper cladding is formed by disposing a panel over the substrate and the core material.

26. The method of claim 25 where in the panel is selected from the group consisting of quartz, silica, and fused silica.

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27. The method of claim 1 wherein the core is formed in the lower cladding and the upper cladding is formed adjacent the upper side of the core.

28. The method of claim 1 wherein the lower cladding, the core and the upper cladding are formed by one or more processing techniques selected from the group of chemical vapor deposition, physical vapor deposition, or sol gel processing.

29. The method of claim 1 wherein the core material has a refractive index higher than the refractive index of the lower and upper claddings.

30. A method of forming waveguide structures, comprising:

depositing a lower cladding on a substrate;

forming a light propagating channel in the lower cladding;

depositing a core material in the light propagating channel; and

bonding an upper cladding to the upper surface of the lower cladding and the core.

31. The method of claim 30 wherein the lower cladding comprises a material selected from the group of USG or undoped silica.

32. (Amended) The method of claim 31 wherein the substrate comprises a material selected from quartz, silica, or fused silica.

33. The method of claim 31 wherein the upper cladding comprises a material having optical properties which are suitable for use as a cladding disposed adjacent the core.

34. The method of claim 30 wherein the upper cladding is bonded to the upper surface of the lower cladding and the upper surface of the core using an adhesive having a refractive index the same as or similar to the upper cladding.

35. The method of claim 30 wherein the light propagating channel is formed by patterning and etching the lower cladding using dry etch technique.

36. The method of claim 35 wherein the core material is deposited using chemical vapor deposition techniques.

37. The method of claim 30 wherein the lower cladding is deposited to a thickness greater than the height of the light propagating channel.

38. The method of claim 30 wherein the lower cladding is deposited to a thickness equal to the height of the light propagating channel.

39. The method of claim 37 wherein the lower cladding is deposited to a thickness greater than or equal to 8μm.

40. The method of claim 38 wherein the lower cladding is deposited to a thickness equal to or less than 8μm.

41. The method of claim 30 wherein bonding an upper cladding comprises flowing a precursor fluid over the core and curing the precursor fluid.

42. A method of forming an optical device, comprising:
depositing a lower cladding on a substrate;
depositing a core material on the lower cladding;
patterning and etching the core material to define one or more core structures;
forming an upper cladding on the core using a sol gel process.

43. The method of claim 42 wherein the upper cladding is formed by flowing a precursor solution over the core structures and then curing the precursor.

A1 cont

44. A method of forming an integrated optical device, comprising:
forming one or more optical waveguide components on a substrate having an area greater than about 400 cm^2.

45. The method of claim 44 further comprising affixing one or more active and/or passive optical components on the substrate.

46. The method of claim 44 wherein the optical waveguide components are selected from the group of splitters, filters, couplers, arrayed waveguide gratings, attenuators, multiplexers, de-multiplexers and combinations thereof.

47. The method of claim 46 further comprising one or more input/output connections.

48. The method of claim 47 wherein the input/output connections provide a transition between an optical fiber and a waveguide component.

49. The method of claim 48 wherein the input/output connections provide a transition from about 8 microns to about 5 microns or less.

50. The method of claim 46 wherein the substrate comprises silica, quartz, fused silica or other material having suitable optical properties to be used as a cladding in an optical waveguide component.

51. The method of claim 42 wherein the substrate comprises silica, quartz, fused silica or other material having suitable optical properties to enable a lower cladding having a thickness less than an upper cladding to confine a core.

52. The method of claim 44 wherein the one or more passive devices formed on the substrate are formed by depositing a lower cladding, depositing a core on the lower cladding and then forming an upper cladding on the core.

A1 cont

53. The method of claim 44 wherein the upper cladding is formed by depositing a film over the lower cladding and the core formed in the lower cladding or bonding a panel on the upper surface of the lower cladding and a core formed in the lower cladding.

54. The method of claim 52 wherein the core is formed by depositing a blanket layer of core material on the lower cladding, patterning the core material and etching the core material to define the core light propagating channels.

55. The method of claim 53 wherein the core is formed by etching core light propagating channels into the lower cladding and then filling the core light propagating channels with core material.

56. The method of claim 44 wherein the percent utilization of the substrate to form the one or more optical waveguide components is greater than about 70%.

57. The method of claim 53 further comprising a planarizing step performed prior to forming the upper cladding.

58. A method for forming an optical device on a substrate, comprising:

forming a lower cladding on a substrate;

depositing a core material on the lower cladding;

patterning and etching the core material to form one or more optical devices;

depositing an upper cladding on the lower cladding and the optical devices by depositing at least a portion of upper cladding and heat treating the deposited portion in situ.

59. The method of claim 58 further comprising repeating the depositing and treating steps for at least two cycles.

A1 cont

60. The method of claim 58 wherein the step of depositing the upper cladding layer comprises depositing a doped material.

61. The method of claim 59 wherein the doped material is BPSG.

62. The method of claim 58 wherein the doped material has a refractive index lower than the refractive index of the core material.

63. The method of claim 58 wherein the doped film is selected to have a lower flow temperature than the core material.

64. The method of claim 58 wherein heat treating comprises a rapid thermal process.

65. The method of claim 64 wherein the rapid thermal process is a single substrate process.

66. The method of claim 61 wherein the rapid thermal anneal process is sufficient to flow the doped material.

67. The method of claim 61 wherein the rapid thermal anneal process is performed at a temperature of at least about 1000°C.

68. The method of claim 63 wherein the rapid thermal anneal is conducted for less than about 70 seconds.

69. The method of claim 58 wherein the core material is PSG, GeO_2, SiON, Si_3N_4, and silicon.

70. The method of claim 58 further comprising densifying the core.

A1 cont

71. (Amended) A method of fabricating multiple optical devices on a glass panel, comprising:

positioning a glass panel in a first processing chamber;
depositing a lower cladding on the glass panel;
densifying the deposited lower cladding;
positioning the glass panel in a second processing chamber;
depositing a core layer on the lower cladding;
patterning and etching the core layer to define a pattern of optical devices;
positioning the glass panel in a third processing chamber; and
depositing an upper cladding over the patterned optical devices.

72. The method of claim 71 wherein the upper cladding is densified following deposition thereof.

73. (Amended) The method of claim 71 wherein the glass panel defines one or more die and the die have one or more optical devices formed thereon and further have a major dimension greater than a minor dimension.

74. The method of claim 71 wherein the utilization of the glass panel is greater than about 75%.

75. The method of claim 72 wherein the devices formed on a single die cover an area of at least about 400 cm^2.

76. The method of claim 73 wherein a single die comprising one or more optical devices has a shape similar to the glass panel.

77. The method of claim 73 wherein the deposition steps are performed in one or more processing systems wherein each deposition step requiring densification is performed on a system having at least one deposition chamber and at least one densification chamber.

A1 cont

78. The method of claim 73 wherein the die and the substrate have the same form factor.

79. The method of claim 73 wherein the at least two sides of a die are parallel to at least two sides of the glass panel on which the die are formed.

80. (Amended) The method of claim 71 wherein the glass panel is 400mm by 500mm.

81. (Amended) The method of claim 71 wherein the glass panel has an area of about 400cm^2 or greater.

82. (Amended) The method of claim 71 wherein the glass panel is a TFT panel.

83. (Amended) The method of claim 71 wherein the glass panel is made of a material selected from the group of quartz, silica, fused silica or combinations thereof.

84. The method of claim 71 wherein the lower cladding is made of a material selected from the group of USG, undoped silica, or combinations thereof.

85. The method of claim 84 wherein the core is made of a material selected from the group of PSG, GeO_2, SiON, Si_3N_4, and silicon.

86. The method of claim 85 wherein the upper cladding is made of a material selected from the group of BPSG.

87. The method of claim 71 wherein the step of depositing a lower cladding layer and densifying the lower cladding is performed on the same processing system.

88. The method of claim 71 wherein depositing the core material is performed by a damascene process.

A1 cont

89. (Amended) A processing system for fabricating optical devices, comprising:

a transfer chamber;

one or more deposition chambers connected to the transfer chamber, the deposition chambers selected from the group of a USG chamber, a PSG chamber, and a BPSG chamber; and

at least one densification chamber connected to the transfer chamber.

90. The processing system of claim 89 wherein the deposition chambers comprise thermal CVD chambers, PECVD chambers, mixed frequency PECVD chambers and PVD chambers.

91. The processing system of claim 90 wherein the at least one densification chamber comprises a rapid thermal anneal chamber.

92. The processing chamber of claim 91 wherein the PECVD chambers are parallel plate type chambers.

93. The processing system of claim 91 wherein the at least one rapid thermal anneal chamber comprises a lamp type thermal processing chamber.

94. The processing system of claim 89 comprising at least one USG deposition chamber, at least one PSG deposition chamber and at least one densification chamber.

95. The processing system of claim 89 comprising at least one BPSG deposition chamber and at least one densification chamber.

96. The processing system of claim 94 wherein the processing system is adapted to process substrates having an area of at least about $400cm^2$.

A1 cont

97. (Amended) The processing system of claim 94 wherein the processing system is adapted to process substrates having an area of at least about $400cm^2$.

98. A method for forming a portion of an optical device on a flat panel, comprising:

positioning a flat panel in a first processing chamber on a processing system;

depositing a lower cladding layer on the substrate;

positioning the substrate in a densification chamber on the same processing system and treating the substrate therein;

positioning the substrate in second deposition chamber to deposit a core layer on the lower cladding layer; and

positioning the substrate in the densification chamber on the processing system and treating the substrate therein.

99. The method of claim 98 wherein the lower cladding layer comprises USG and the core layer comprises PSG.

100. The method of claim 99 wherein treating the substrate in the densification chamber comprises exposing the substrate to a rapid thermal anneal process.

101. The method of claim 100 wherein the substrate is heated to a temperature above about 1000°C.

102. The method of claim 100 further comprising performing lithography steps on the substrate to define a core pattern and then depositing an upper cladding on the core pattern and then treating the substrate in a densification chamber.

103. The method of claim 102 wherein the flat panel has an area of at least about 400cm^2.

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104. The method of claim 103 wherein the flat panel has a major side longer than a minor side.

105. The method of claim 103 wherein the flat panel is made of a material selected from the group of quartz, silica, and fused silica.

106. A method of forming an optical device on a substrate, comprising depositing one or more of a lower cladding, a core and an upper cladding and heat treating one or more of the lower cladding, the core and the upper cladding in situ following deposition thereof.

107. The method of claim 106 further comprising depositing the core layer and forming one or more light propagating channels in the core.

108. The method of claim 107 wherein the upper cladding is heat treated in situ following deposition thereof.

109. The method of claim 108 wherein the lower cladding is heat treated in situ following deposition thereof.